CLAIMS

1-14. (cancelled)

15. (new) Method for the reconstruction of holographic images in digital holography, comprising the following steps:

- the hologram of an investigated object is detected and recorded by a detection device (9) that is constituted by an integrated array of image detection elements (9), that spatially sample the hologram with a number N of pixels along the x-axis of the hologram plane, each having length Δx, and a number M of pixels along the y-axis of the hologram plane, each having length Δy, thus obtaining a rectangular array of a number $V_r = N_r \cdot M_r$ of values (51) proportional to light intensity values of the hologram, such a rectangular array being called a digital hologram;
- the hologram is reconstructed (13,15,16,17,18) in the observation plane, starting from the digital hologram to obtain a reconstructed image of the investigated object in such observation plane;

the method being characterised in that the reconstruction of the hologram comprises the following sub-steps:

A. Adding new arbitrary values to the digital hologram, obtaining an expanded array comprised of $V_e = N_e \cdot M_e$ elements (50, 51), where $N_e = N_r + N'$ and $M_e = M_r + M'$ with N', M' being integer numbers, each arbitrary value being equal to the same constant value (50);

B. Applying the discrete Fresnel Transform on the expanded array of $V_e = N_e \cdot M_e$ values to obtain a final array of values proportional to light intensity values of the hologram, such final array being the reconstructed image of the investigated object;

the total numbers N_e, M_e of added arbitrary values being inversely proportional to the respective pixel sizes $\Delta\xi$ and $\Delta\eta$ to be obtained in the observation plane for the reconstructed image (14), according to the relationships: $\Delta\xi = (\lambda d/N_e \Delta x)$ and $\Delta\eta = (\lambda d/M_e \Delta y)$, where λ is the wavelength of the wave beam striking the object of which the hologram is recorded, and d the distance between the detection device and the object of which the hologram is detected.

16.(new): Method according to claim 15, characterized in that said arbitrary constant values (50) are null values.

17.(new): Method according to claim 15, characterized in that said arbitrary constant values (50) are arranged externally to said array of V_r values (51), to obtain an extended array in which digital hologram is embedded.

18.(new): Method according to claim 17, characterized in that said arbitrary constant values (50) are arranged in a symmetrical way, i.e. said N',M' values are arranged symmetrically around said digital hologram.

19.(new): Method according to claim 17, characterized in that said arbitrary constant values (50) are arranged in a non-symmetrical way, i.e. said N',M' values are arranged non-symmetrically around said digital hologram.

20.(new): Method according to claim 15, characterized in that, after the second step, if each holographic image sampling interval is not equal or less than a certain threshold, the number of values N'·M' (50) added to the digitized hologram array is increased and the hologram reconstruction step is carried out again.

21.(new): Method according to any claim 20, characterized in that said threshold is a function of the signal-to-noise ratio of the holographic image.

22.(new): Method according to claim 1 characterized in that $N_e = (\lambda d/\Delta x^2)$, $M_e = (\lambda d/\Delta y^2)$, $\Delta\xi = \Delta x$, $\Delta\eta = \Delta y$.

23.(new): Method according to claim 1, characterized in that the method is performed for more than one holographic images detected at the same time for different wavelength λ, said more than one images being subsequently superposed in order to obtain a multi-colour final holographic image (14).

24.(new): Computer program characterized in that it comprises code means apt to execute, when running on a computer, the method according to claim 1.

25.(new) Memory medium, readable by a computer, storing a program, characterised in that the program is the computer program according to claim 9.

26.(new) Apparatus for detection of holographic images, comprising an integrated array of image detection devices (9) and a digitized hologram processing unit, characterised in that the processing unit processes the data detected by said a detection device (9) by using the method according to claim 1.